



NDCEE

National Defense Center for Energy and Environment



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(Installations and
Environment)

Demonstration of Vegetative Roofing at Army Installations

Ms. Heidi Anne Kaltenhauser, *CTC*

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Presentation Highlights

- What is Vegetative Roofing?
- Demonstration approach?
- What are demonstration findings to date?

Vegetative Roof



Viking Village



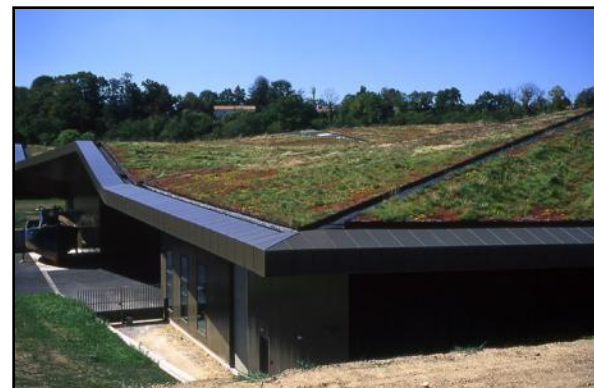
Faroe Islands



New York



Chicago City Hall



Museum in France

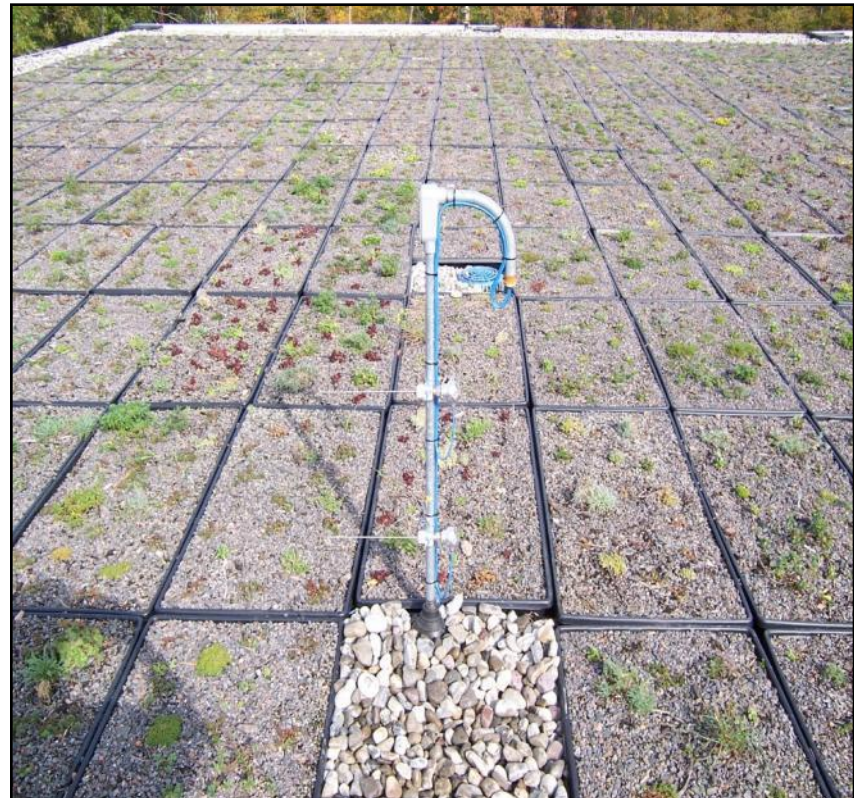
Background

- Objective: Demonstrate and validate vegetative roof technology at Tobyhanna Army Depot
- Department of Army Green Building Requirements
 - FY08 LEED Silver Standard
- DoD Trends
 - Energy efficiency
 - Green building
- Green Roof
 - Sustainable technology
 - Enhance visual character
- Installation Challenges
 - Stormwater runoff
 - Energy efficiency



Technical Approach

- Monitoring System
 - Thermocouples
 - Energy Consumption
 - Temperature Differential
 - Vertical Flow Meters
 - Runoff Quantity
 - Grab Samples
 - Runoff Quality



Thermocouple Array

Technical Approach (cont'd)

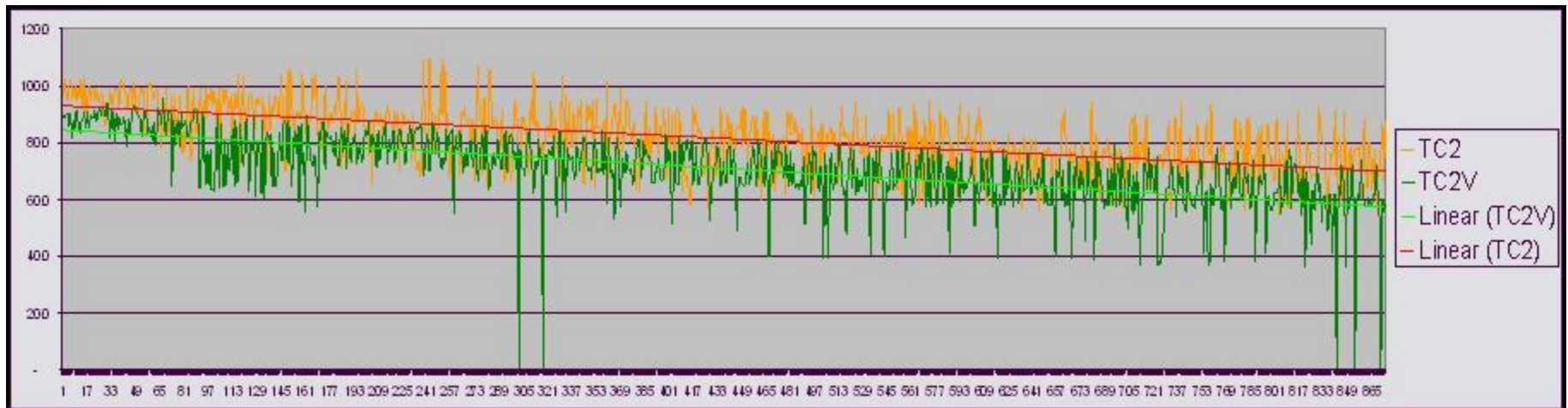
- Modular System
 - Easy maintenance
 - Adaptable (e.g., equipment installation)
 - 14,007 ft²
- Net Increase of 4 lbs/ft²
 - Rock Ballast removed- 8 lbs/ ft²
 - Roof Modules- 12 lbs/ft² fully saturated
- 64 Species of Plants
 - Mostly Sedum
 - Some Alpine Species



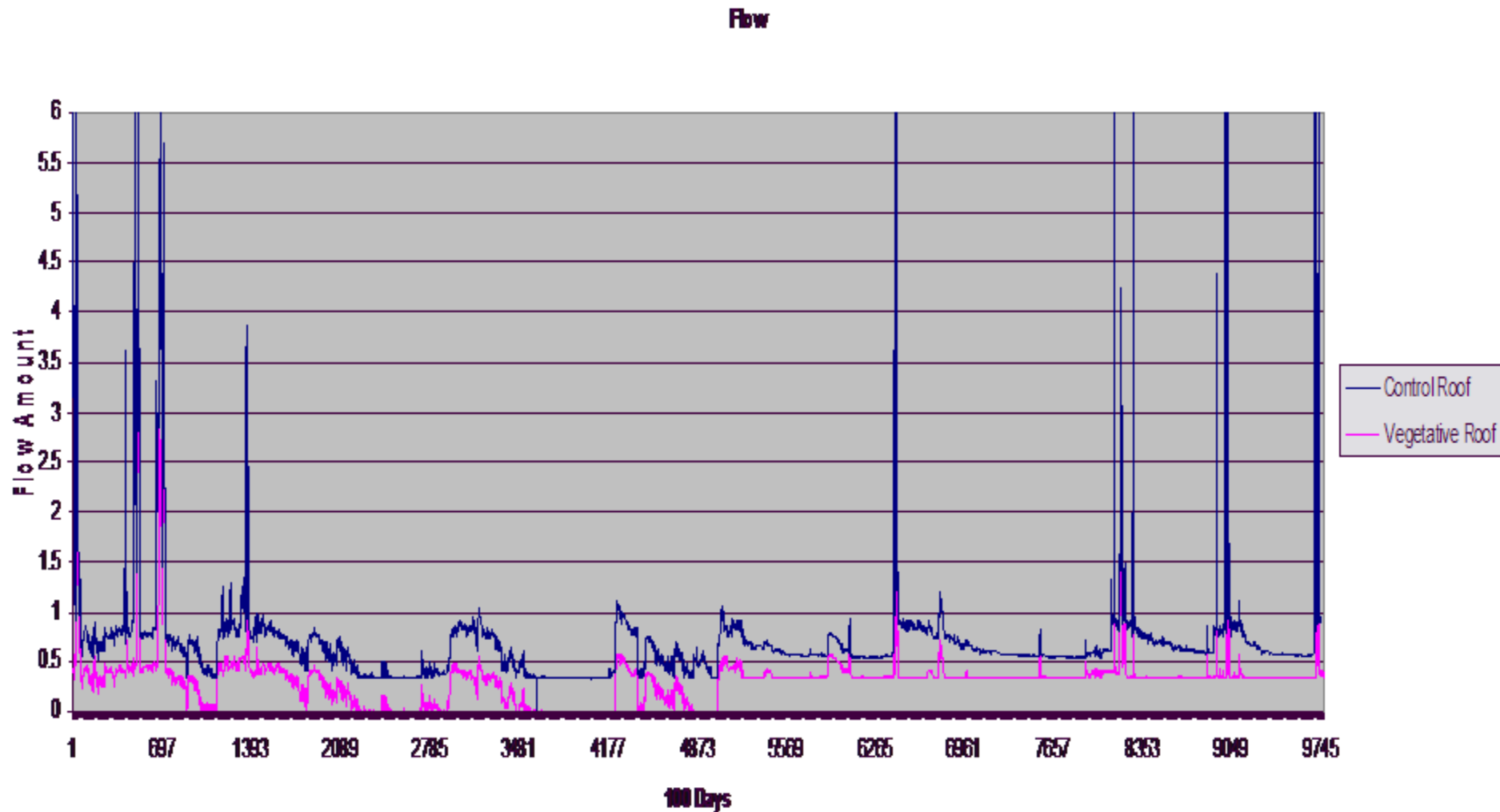
Sedum rubrotinctum

Energy Results

- Urban Heat Island Effect
 - Average 10°F cooler (ambient temperature above 50°F)
 - Average 2°F warmer (ambient temperature below 50°F)
- Energy Savings
 - Projected 40% energy savings based on tons of air conditioning saved



Water Quantity Results



- 10% Reduction in Flow
- 6500 Gallon Reduction

Water Quality Results

- Components Sampled
 - Nitrogen, Phosphates, TOC, TDS and pH
- Vegetative Roof
 - Decrease in quality
 - Due to initial fertilizer use
 - Increase in quality over time
 - With organic fertilizer



Vertical Flow Meter

Plant Growth August 2006



Plant Growth April 2007



Plant Growth May 2007



Plant Growth July 2007



Plant Growth August 2007



Contact Information

NDCEE Technical Monitor

Task: 0429 A1 - Vegetative Roofing

Name: Mr. Mike Parrent

Organization: Tobyhanna Army Depot

E-mail: michael.parrent@us.army.mil

Phone Number: (570) 895-6105

NDCEE Project Manager

Name: Carter Mullen

Organization: CTC/NDCEE

E-Mail: mullenc@ctc.com

Phone Number: (703) 310-5647

www.ndcee.ctc.com

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